

FINAL PROGRESS REPORT FOR S-92504-Z:
A THREE-DIMENSIONAL ANALYSIS OF THE GALACTIC GAMMA-RAY
EMISSION RESULTING FROM COSMIC-RAY INTERACTIONS WITH THE
INTERSTELLAR GAS AND RADIATION FIELDS

7N-90

1997 000 244

TASK LEADER: Thomas J. Sodroski
ATR: Eli Dwek

Description of Activities:

The contractor will provide support for the analysis of data under ADP (NRA 96-ADP-09; Proposal No. 167-96adp). The primary task objective is to construct a 3-D model for the distribution of high-energy (20 MeV - 30 GeV) gamma-ray emission in the Galactic disk. Under this task the contractor will utilize data from the EGRET instrument on the Compton Gamma-Ray Observatory, H I and CO surveys, radio-continuum surveys at 408 MHz, 1420 MHz, 5 GHz, and 19 GHz, the COBE Diffuse Infrared Background Experiment (DIRBE) all-sky maps from 1 to 240 μm , and ground-based B, V, J, H, and K photometry. The respective contributions to the gamma-ray emission from cosmic ray/matter interactions, inverse Compton scattering, and extragalactic emission will be determined.

This task is supported by T. J. Sodroski (SAC).

Significant Accomplishments:

During this initial year of our 2-year program we have successfully completed the most critical part of our modelling effort, the derivation of a detailed 3-D map of the Galactic interstellar radiation field (ISRF) from 0.44 μm to 1000 μm based primarily on data from the DIRBE instrument on board NASA's Cosmic Background Explorer (COBE) satellite, and ground-based B, V, J, H, and K photometry. A radiative transfer code has been implemented to derive the radial and z-distance variations of the ISRF between 1 and 1000 μm . The code utilizes the stellar input parameters obtained from Freudenreich's (1996) analysis of the DIRBE 1 - 5 μm data, and the dust infrared spectra obtained from a recent 3-D analysis (Sodroski et al. 1997) of DIRBE 12 - 240 μm observations of the Galactic plane region. In order to account for

the processes of magnetic field and cosmic ray generation and diffusion in the Galaxy and the possible connection between a gamma-ray halo and the "thick radio disk".

3) The use of ISRF model to constrain the various models for dust grains in the interstellar medium.

4) Investigation of the effects of radiation pressure on the dynamics of dust grains in the interstellar medium.

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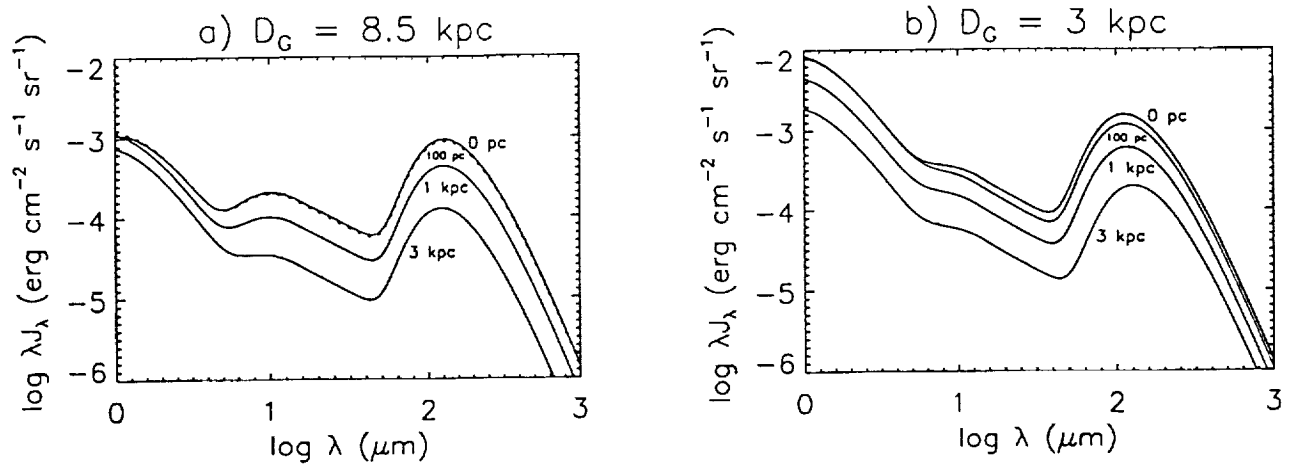


Fig. 1. — (a) Galactic interstellar radiation field at a Galactocentric distance of 8.5 kpc. Curves labeled 0 pc, 100 pc (*dotted line*), 1 kpc, and 3 kpc correspond to various z -distances above the Galactic midplane. (b) Same as (a), for a Galactocentric distance of 3 kpc.

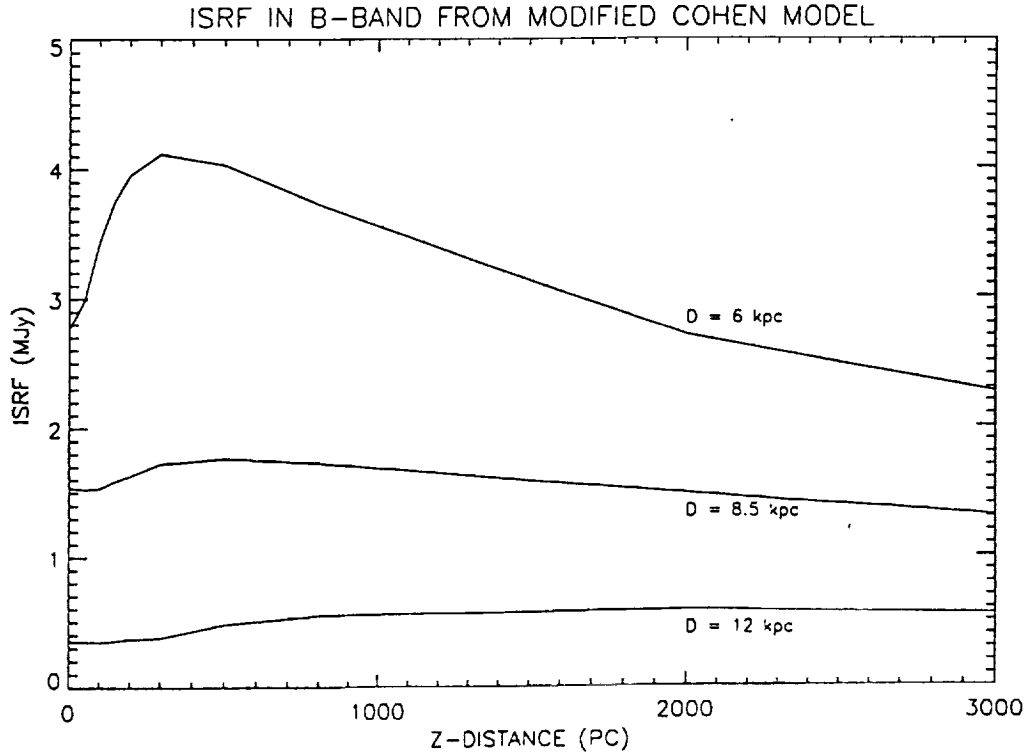


Fig. 2. — The z -distance variation of the Galactic interstellar radiation field in the B-band ($\lambda_{\text{eff}} = 0.44 \mu\text{m}$), for various Galactocentric distances D .

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16. Abstract The contractor will provide support for the analysis of data under ADP (NRA 96-ADP-08; Proposal No. 167-96adp). The primary task object is to construct a 3-D model for the distribution of high-energy (20 MeV - 30 GeV) gamma-ray emission in the Galactic disk. Under this task the contractor will utilize data from the EGRET instrument on the Compton Gamma-Ray Observatory, HI and CO surveys, radio-continuum surveys at 408 MHz, 1420 MHz, 5 GHz, and 19 GHz, the COBE Diffuse Infrared Background Experiment (DIRBE) all-sky maps from 1 to 240 um, and ground-based B,V,J,H, and K photometry. The respective contributions to the high-latitude gamma-ray emission from cosmic ray/matter interactions, inverse Compton scattering, and extra-galactic emission will be determined.			
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13. ABSTRACT (Maximum 200 words) This final report outlines the progress of the contractor's support for the analysis of data under ADP (NRA 96-ADP-08; Proposal No. 167-96adp). The primary task object was to construct a 3-D model for the distribution of high-energy (20 MeV-30GeV) gamma-ray emission in the Galactic disk. Under this task the contractor was to utilize data from the EGRET instrument on the Compton Gamma-Ray Observatory, HI and CO surveys, radio-continuum surveys at 408 MHz, 1420 MHz, 5 GHz, and 19 GHz, the COBE Diffuse Infrared Background Experiment (DIRBE) all-sky maps from 1 to 240 um, and ground-based B, V, J, H and K photometry. The respective contributions to the high-latitude gamma-ray emission from cosmic ray-matter interactions, inverse Compton scattering, and extra-galactic emission were to be determined.				
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